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Borneodessus zetteli kalimantanensis Balke, Hendrich, Mazzoldi & Biström, 2002: first record of a rare and little-known diving beetle from Sarawak (Coleoptera, Dytiscidae)

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Abstract

The diving beetle *Borneodessus zetteli kalimantanensis* Balke, Hendrich, Mazzoldi & Biström, 2002, an endemic species of Borneo, is recorded for the first time from Sarawak. The specimen was collected from submerged rootlets of a large shore tree from the Pa' Ngaruren River (Kelabit Highland, Sarawak) with *Neptosternus kodadai* Hendrich & Balke, 1997 and *N. quadrimaculatus* Hendrich & Balke, 1997. Two species of the genus *Elmomorphus* Sharp, 1881, *Stenomystax minutus* Kodada, Jäch & Čiampor, 2003, and S. *depressus* Kodada, Jäch & Čiampor, 2003 shared the same microhabitat.

Keywords

Borneo, diversity, distribution, rheobiont, submerged rootlets

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Introduction

Borneodessus Balke, Hendrich, Mazzoldi & Biström, 2002 represents the only endemic genus of Dytiscidae in Borneo. Its occurrence in the other Sunda Islands was thought to be probable (Balke et al. 2002), but it has not been recorded outside of Borneo. We know little about its biology and distribution. The species is a rheobiont, and it has been collected only twice to date. Two subspecies are established, *B. zetteli zetteli* Balke, Hendrich, Mazzoldi & Biström, 2002 from Danum Valley in Sabah and B. *zetteli kalimantanensis* Balke, Hendrich, Mazzoldi & Biström, 2002 discovered from Apokayan in the East Kalimantan. The description of the nominotypical subspecies is based on male and female specimens collected in small shallow isolated puddles at the edge of a river (Balke et al. 2002). Similarly, in the subspecies from Kalimantan, only two males and one female were sampled among mats of floating roots in small, isolated puddles at the edges of streams (Balke et al. 2002). The habitat of *B. zetteli* is very similar to that of *Microdytes* Balfour-Browne, 1946, *Allopachria* Zimmermann, 1924, *Neptosternus* Sharp, 1882, and many species of Elmidae, Dryopidae, and Hydraenidae. A faunistic survey on the diversity of Elmidae and Dryopidae in the Malaysian state of Sarawak was carried out by Ján

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Kodada and Dávid Selnekovič during 2018 and 2019. Intense sampling from submerged rootlets of a large shore tree in the small, shaded Pa' Ngaruren River near the village of Ramudu (Kelabit Highland, northeastern Sarawak) remarkably yielded a single specimen of *B. zetteli kalimantanensis* and several species of the genera *Neptosternus* (Dytiscidae), *Elmomorphus* Sharp, 1881, and *Stenomystax* Kodada, Čiampor & Jäch, 2003 (Dryopidae). These records we discuss below.

Methods

We used a D-frame hand net applying a multihabitat scheme to sample significant habitats proportionally according to their presence within a sampling reach. Additionally, we sampled microhabitats covering less than 5% of the studied area, such as submerged mosses, exposed submerged fine rootlets of shore trees, submerged wood and accumulated dead leaves. Generally, we sampled by positioning the net and disturbing the substrate for a distance that equals the square of the frame width upstream of the net. When taking samples from moss or submerged rootlets, we positioned the net immediately downstream of the sampled substrate while the substrate was gently combed by hand or a soft brush, enabling the specimens to float into the net. After several replicates, we rinsed the collected material two to three times with stream water, and we sorted specimens directly in the field and preserved them in 96% ethanol.

The material examined is deposited at the Department of Zoology, Comenius University, Bratislava, Slovakia (CUBS) and Forest Department Sarawak, Kuching, Sarawak, Malaysia.

We examined specimens using a Leica M205C stereomicroscope with fusion optics and diffuse lighting at magnifications up to 160×. Habitus photograph we produced with a Zeiss Axio-Zoom.V16 stereomicroscope with diffuse LED lighting and a Canon 5D Mark IV camera attached. The final habitus photograph was created by stacking numerous focal planes using the image-stacking software ZereneStacker (https://zerenesystems.com/cms/stacker).

Results

***Borneodessus zetteli kalimantanensis* Balke, Hendrich, Mazzoldi & Biström, 2002**
Figure 1A

Type locality. Indonesia, East Kalimantan, Apokayan, Sunggai Barang, Lalut Wai, 850 m a.s.l.

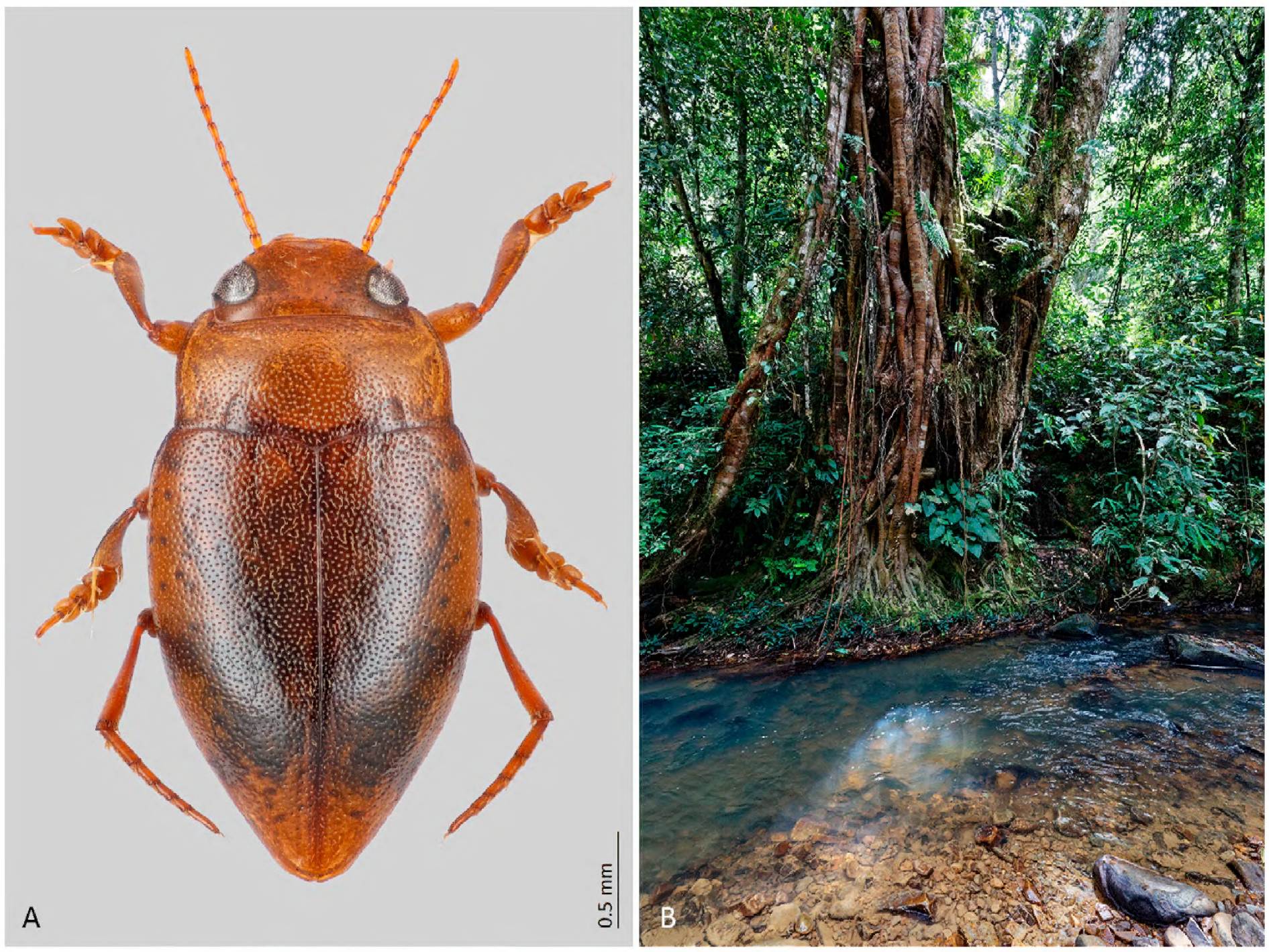

Figure 1. A. Habitus of *Borneodessus zetteli kalimantanensis* Balke, Hendrich, Mazzoldi & Biström, 2002; specimen from Sarawak, body length 3.29 mm. **B.** Habitat of *B. zetteli kalimantanensis*, Pa' Ngaruren River, Sarawak.

New record. MALAYSIA – **Sarawak** • Miri district; Ramudu environment, Pa' Ngaruren River; 3°34'05"N, 115°29'41"E; 919 m alt.; 27.VI.2018; J. Kodada & D. Selnekovič lgt.; 1 specimen CUBS. Figure 2.

Identification. According to Balke et al. (2002), *Borneodessus zetteli* is a rather large species of Bidessini, with a robust, broadly ovate body with slight discontinuity between the elytron and the pronotum in dorsal view (Fig. 1A). The pronotum is broadest at the posterior corners, rather parallel-sided over the basal half, and slightly narrowing towards the anterior angle over the anterior half. The base of the elytra is the same width as the base of the pronotum; the elytron distinctly broadens immediately posteriad of the base, thus producing the impression of a pronotal-elytral discontinuity. The body and appendages are yellowish. The elytron has dark patches. However, these patches are not very well defined and hardly contrast against the background. The head is without a cervical line. In males the head has an angulate frontal outline, which is margined and mediofrontally impressed between the eyes. The pronotum bears narrow lateral beads, short and only weakly impressed basolateral striae, and curved striae. The scutellum is not visible. The elytron lacks baso-lateral and sutural stria. The epipleuron is without a deep basal cavity and/or basal carina; it is broad anteriorly but narrows towards the apex and is visible to the level of the penultimate visible sternum.

The first three pro- and mesotarsomeres are notably dilated in both sexes; the fourth pro- and mesotarsomere are small but not entirely covered by the preceding tarsomere. Protarsomere 3 in males is slightly shorter than in females. The prosternal process is broadly triangular and with a distinct ridge. This subspecies resembles *B. zetteli zetteli* but differs being distinctly larger (3.2 ± 3.5 mm) and in having the median lobe of the aedeagus with a narrower tip in ventral view; also, the lateral margins are slightly more parallel than in *B. zetteli* (see Balke et al. 2002: figs. 4, 5).

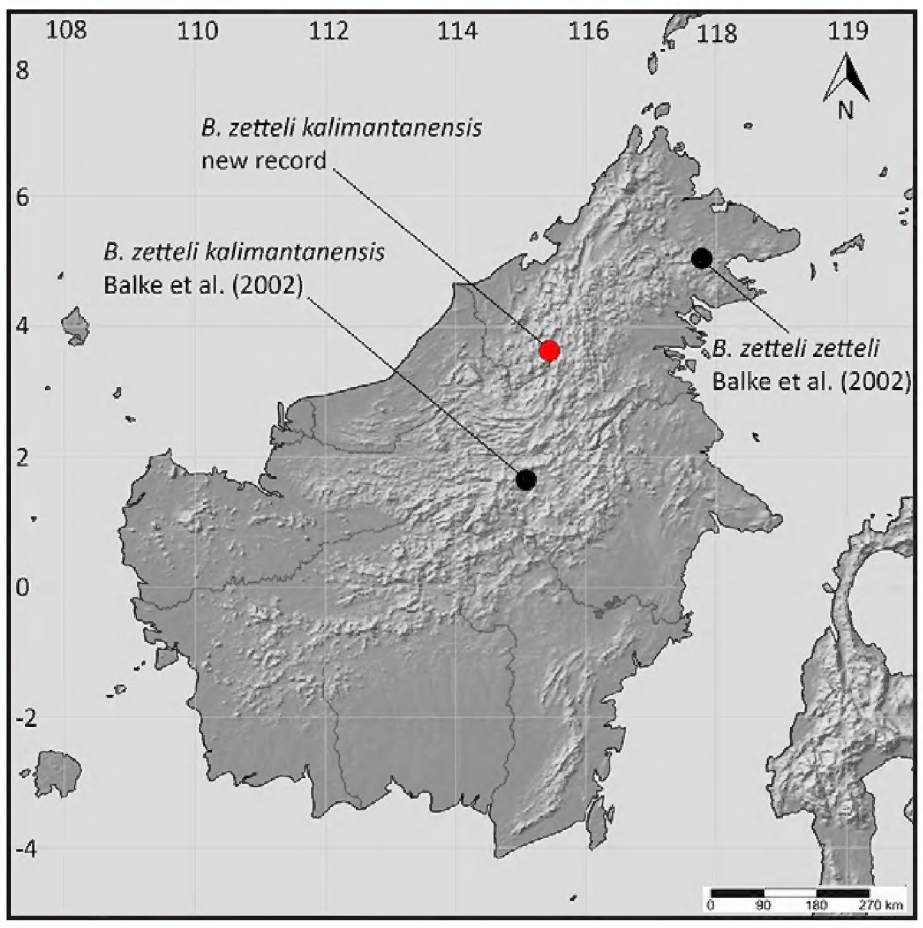

Figure 2. Distribution of *Borneodessus zetteli*. Published records were taken from Balke et al. (2002).

The specimen of *Borneodessus* from Sarawak clearly belongs to *B. zetteli kalimantanensis* based on its characteristic habitus, coloration, size (3.29 mm), and other external features (Balke et al. 2002). Furthermore, we compared the new specimen with type specimens in the Natural History Museum in Vienna, Austria.

Habitat. Type specimens were collected in shallow water among mats of floating roots and in small, isolated puddles at the edges of streams (Balke et al. 2002). The single specimen from Sarawak was collected from submerged rootlets of a large shore tree in a small river, shaded entirely by remnants of degraded primary forest (Fig. 1B).

Distribution. Indonesia: East Kalimantan (Balke et al. 2002), and Malaysia: Sarawak (first record; Fig. 2), Sabah.

Discussion

One of the world's largest islands, Borneo has a fascinating and rich aquatic insect fauna. The microhabitats of submerged roots of shore vegetation, submerged moss on stones, isolated puddles alongside streams with accumulated leaves, and wood are substantial in harboring numerous animals. Dystiscid species of the genera *Microdytes*, *Allopachria*, and *Neptosternus* that inhabit these microhabitats in the primary forests show a narrow distribution range. In recent decades, many endemic species have been described from Borneo (e.g., Hendrich and Balke 1997; Wewalka 1997, 2000). *Borneodessus* is one of the least-known diving beetles, and only five specimens have been sampled to date. During our research of riffle beetles, we also examined the microhabitats of submerged roots, which are the preferred habitat of species of the genera *Prionosolus* Jäch & Kodada, 1997, *Homalosolus* Jäch & Kodada, 1996, *Leptemis* Sharp, 1888 (Elmidae), *Stenomystax*, and *Elmomorphus* (Dryopidae). However, collecting specimens from this microhabitat is challenging and time-consuming but provides very good results. In contrast to a single specimen of *Borneodessus zetteli kalimantanensis*, we found many individuals of the aforementioned taxa in the Pa' Ngaruren River. The diving beetles, *Neptosternus kodadai* Hendrich & Balke, 1994 and *N. quadrimaculatus* Hendrich & Balke, 1994 were very abundant here. We also recorded numerous individuals of *Stenomystax minutus* Kodada, Jäch & Čiampor, 2003, *S. depressus* Kodada, Jäch & Čiampor, 2003, and two species of the genus *Elmomorphus*. Repeated examination of numerous small, isolated puddles with leaves and collecting from submerged rootlets in other localities of Sarawak (2018–2019) did not reveal any other specimens of *Borneodessus*. In summary, our sampling activities reveal the occurrence of a scarce and rarely collected species in Sarawak.

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Authors' Contributions

Funding acquisition: JK. Visualization: JK, DS, MB, LH. Writing – original draft: JK, LH, MB. Writing – review and editing: JK, DS, LH, MB.

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